Amendments to the Specification:

Please replace the subheading that immediately precedes paragraph [0005] on page 2 with the following subheading:

--~~Brief~~ Summary of the Invention—

Please replace paragraph [0007] with the following amended paragraph:

[0007] Figure 1 illustrates an exemplary embodiment of the invention in which integrated circuits are electromagnetically coupled to a transmission line.

Figure 2 is a plan view illustrating the integrated circuits of Figure 1 on a printed circuit board.

Figure 3 is a partial, cross-sectional view of the integrated circuits and printed circuit board of Figure 2.

Figure 4 illustrates a block diagram of an exemplary integrated circuit that may correspond to ~~the~~ an integrated circuit (e.g., 14(1)) of Figure 1.

Figure 5 illustrates an exemplary embodiment of the invention in which eight integrated circuits are electromagnetically coupled to a transmission line.

Figures 6a and 6b illustrate exemplary transmitter and receiver circuits that may correspond to the transceiver 16 in Figure 4.

Figure 7 illustrates exemplary coupling characteristic data for an exemplary embodiment of the invention.

Figure 8 illustrates a block diagram of an exemplary integrated circuit that may correspond to an integrated circuit that may be used with a plurality of contactless interconnects of the invention.

Figure 9 illustrates an exemplary embodiment of the invention in which a plurality of integrated circuits are each electromagnetically coupled to a plurality of transmission lines.

Figure 10 is a cross-sectional view from Figure 9.

Figure 11 is a cross-sectional, side view of an embodiment of the invention in which daughter cards are electromagnetically coupled to a mother board.

Figure 12 is a detailed cross-sectional view of the connector elements of Figure 11.

Figure 13 illustrates an exemplary integrated circuit that may be used in the embodiment of the invention illustrated in Figure 14.

Figure 14 illustrates a cross-sectional view of an exemplary embodiment of the invention in which a plurality of integrated circuits are electromagnetically coupled to a ring bus structure.

Figure 15 illustrates a cross-sectional view of an exemplary embodiment of the invention in which a plurality of stacked integrated circuits are electromagnetically coupled.

Figure 16 illustrates an exemplary embodiment of the invention in which dual sides of an integrated circuit are electromagnetically coupled.

Figures ~~17a-17c~~ 17a, 17b, and 17c illustrate exemplary embodiments of the invention in which two or more integrated circuits are directly electromagnetically coupled.

Figure 18 illustrates an exemplary embodiment of an integrated circuit having a spiral electromagnetic coupler.

Figure 19 illustrates an equivalent circuit diagram corresponding to Figure 18.

Please replace paragraph [0012] with the following amended paragraph:

[0012] Each integrated circuit 14 may also include a radio frequency (RF) transceiver 16 and a small electromagnetic coupler 18. Preferably, the electromagnetic coupler is sufficiently small that it can be formed on or within the integrated circuit using standard semiconductor fabrication techniques. Alternatively, the electromagnetic coupler 18 could be fabricated as part of the semiconductor package. Thus, the electromagnetic coupler is preferably smaller than a typical semiconductor die. In the embodiment illustrated in Figures 1-4, input/output interface 15 preferably provides a serial interface to the transceiver 16, and transceiver 16 encodes the data received from input/output interface 15 using any suitable RF modulation scheme. (See Figure 4.) Nonexclusive examples of suitable RF modulation schemes include amplitude modulation (AM), frequency modulation (FM), phase code modulation (PCM), phase modulation (PM), or any combination of the foregoing. It is believed that modulation schemes used in modem technology may be particularly advantageous in the present invention. However, the specific design of the transceiver and the specific modulation scheme are not critical to the invention, and any suitable transceiver and modulation scheme may be used with the present invention.

Please replace paragraph [0016] with the following amended paragraph:

[0016] Regardless of its specific implementation, the transmission line 22 is preferably embedded within a printed circuit board 21. However, the transmission line may be formed on or otherwise mounted to provide an interconnect channel between electromagnetically coupled circuits. As mentioned above, in order to prevent or minimize reflections, the transmission line 22 is preferably terminated at one or both ends in its characteristic impedance 27, 29 (see, e.g., Figures 1 and 4).

Please replace paragraph [0018] with the following amended paragraph:

[0018] ~~Modulated~~ As shown in Figure 1 and other figures, modulated signals induced on transmission line 22 by the electromagnetic coupler 18(1) of one integrated circuit 14(1) may be detected by another integrated circuit 14(x) in the system 10. That is, the modulated signal in transmission line 22 induces a similar but attenuated signal in the electromagnetic coupler 18(x) of the other integrated circuit or circuits 14(x) whose electromagnetic couplers 18(x) are disposed in proximity to the transmission line 22 so as to be electromagnetically coupled to the transmission line.

Please replace paragraph [0025] with the following amended paragraph:

[0025] Directional coupling between couplers 18(1), 18(2), 18(3), 18(4), 18(5), 18(6), 18(7), and 18(8) and transmission line 22, as discussed above, may be advantageous when, for example, the logic circuit 12 of integrated circuit 14(1) is a microprocessor, and the logic circuits 12 of the other integrated circuit or circuits ~~14(x)~~ (e.g., 14(2), 14(3), 14(4), 14(5), 14(6), 14(7), and/or 14(8)) are memories or other devices that communicate with the microprocessor but not with one another. An example of such a case is discussed below with respect to Figure 5. In such a case, the electromagnetic coupler 18(1) of integrated circuit 14(1) may be oriented to transmit signals to the right on transmission line 22 and to receive signals traveling to the left ~~of~~ on transmission line 22. The electromagnetic couplers ~~18~~ 18(2), 18(3), 18(4), 18(5), 18(6), 18(7), and/or 18(8) of integrated circuit or circuits ~~14(x)~~ 14(2), 14(3), 14(4), 14(5), 14(6), 14(7), and/or 14(8) would be oriented to transmit signal to the left and to receive signals transmitted to the right. Such directional coupling can limit the load drawn by integrated circuit or circuits ~~14(x)~~ 14(2), 14(3), 14(4), 14(5), 14(6), 14(7), and/or 14(8) when any one of those integrated circuits is transmitting

to integrated circuit 14(1). Of course, coupling between an electromagnetic coupler ~~18~~ (e.g., 18(1), 18(2), 18(3), 18(4), 18(5), 18(6), 18(7), and/or 18(8)) and transmission line 22 can be made bi-directional by simply leaving electromagnetic coupler ~~18~~ (e.g., 18(1), 18(2), 18(3), 18(4), 18(5), 18(6), 18(7), and/or 18(8)) open circuited or grounded.

Please replace paragraph [0026] with the following amended paragraph:

[0026] A simple, exemplary transceiver circuit is illustrated in Figures 6a and 6b. Figure 6a illustrates an exemplary transmitter 300 portion of the circuit, and Figure 6b illustrates an exemplary receiver 400 portion of the circuit. Data to be transmitted is input at terminal 302 of XOR gate 306. (See Figure 6a.) A square wave carrier signal is input at terminal 304 of XOR gate 306. The square wave carrier signal may be a system clock signal. The output 308 of XOR gate 306 is a bipolar phase shift keying (BPSK) modulated signal containing both the data and the clock to be transmitted. Resistor 310 controls the amount of current that will flow through coupling loop 312. Coupling loop 312 radiates electromagnetic energy corresponding to the modulated signal, which, as discussed above, induces a similar but attenuated modulated signal in any other coupling loop or transmission line that is electromagnetically coupled to coupling loop 312.

Please replace paragraph [0030] with the following amended paragraph:

[0030] Figure 5 illustrates an exemplary electronics system 11 in which eight integrated circuits ~~14(1) through 14(8)~~ 14(1), 14(2), 14(3), 14(4), 14(4), 14(5), 14(6), 14(7), and 14(8) are electromagnetically coupled to transmission line 22. For example, the eight integrated circuits may be a microprocessor 14(1) and seven memory devices ~~14(2)-14(7)~~ 14(2), 14(3), 14(4), 14(5), 14(6), and 14(7). The eight integrated circuits ~~14(1) through 14(8)~~ 14(1), 14(2), 14(3), 14(4), 14(4), 14(5), 14(6), 14(7), and 14(8) are mounted on a printed circuit board (not shown in Figure 5). Each of the electromagnetic couplers ~~18(1) through 18(8)~~ 18(1), 18(2), 18(3), 18(4), 18(4), 18(5), 18(6), 18(7), and 18(8) are electromagnetically coupled to transmission line 22. The system 11 may be partially or fully shielded. Exemplary shielding configurations are described more fully below.

Please replace paragraph [0039] with the following amended paragraph:

[0039] Many multiplexing, data exchange, and communication schemes and protocols are known in the electronics fields, and any such scheme or schemes or combination thereof may be used with the above described embodiment for transmitting data between integrated circuits. For example, known multiplexing schemes include without limitation time division multiplexing, frequency division multiplexing, and code division multiplexing. Exemplary, known protocols ~~include without limitation~~ include, without limitation, Scalable Coherent Interface (SCI), Fire Wire, Ethernet, and Universal Serial Bus. Again, any such multiplexing scheme or protocol or combination thereof may be used with the instant invention.

Please replace paragraph [0055] with the following amended paragraph:

[0055] Figures ~~8, 9, and 10~~ 9 and 10 illustrate an exemplary configuration of an electronics system 59 in which a plurality of integrated circuits 60(1)-60(x) each have four transceivers 62(1)-62(x). The plurality of integrated circuits 60(1)-60(x) are mounted on a surface 65 of a printed circuit board 66. Embedded within the printed circuit board (and shown in dashed-outline form in Figure 9) are four transmission lines 76. As discussed above, the transmission lines 76 may alternatively be formed on the printed circuit board 66. Each of the four electromagnetic couplers 68 (see Figure 10) on each of the plurality of integrated circuits 60(1)-60(x) is coupled to one of the transmission lines 76. Preferably, each of electromagnetic couplers ~~68(1)-68(x)~~ 68 (see Figure 10) are disposed within approximately five millimeters of the its corresponding transmission line 76. The invention is not limited, however, to placement of any electromagnetic coupler 68 (see Figure 10) within five millimeters of a transmission line 76. In this manner, transmission lines 76 form a four-path, bus-like structure in which the plurality of integrated circuits 60(1)-60(x) can contactlessly communicate with each other over the bus-like structure.

Please replace paragraph [0056] with the following amended paragraph:

[0056] As described above, the contactless communication paths in electronics system ~~10~~ 59 of ~~Figure 9~~ Figures 9 and 10 may optionally be fully or partially shielded. Figure 10 illustrates ~~an~~ exemplary ~~embodiment with~~ partial shielding of the electronics system 59 illustrated in Figure 9. As shown in Figure 10, a shielding plane 69 shields the circuitry on integrated circuit 60 from the four electromagnetic couplers 68 of integrated circuit 60. Each of the four transceivers 62 in integrated circuit 60 are electrically connected to an electromagnetic coupler 68 on the integrated circuit 60 through vias 67 extending though separate gaps in a shielding plane 69. Additional shielding may be provided by shielding planes or traces 80 disposed between transmission lines 76, and still further shielding may be provided by shielding planes 74 and 78, between which transmission lines 76 are located as illustrated in ~~Figure 6~~ Figure 10. If shielding plane 74 is included, gaps 72 in shielding plane 74 between each electromagnetic coupler 68 and each transmission line 76 are included in shielding plane 74. Integrated circuit 60 can then be positioned on printed circuit board 66 so that its electromagnetic couplers 68 are electromagnetically coupled to the transmission lines 76 through the gaps 72.

Please replace paragraph [0064] with the following amended paragraph:

[0064] As shown in Figure 13, an integrated circuit ~~90~~ 190 may be configured with a transmitting coupler 102 and a separate receiving coupler 98 adapted for communicating through an electromagnetically coupled ring or token ring bus. Integrated circuit 190 may also include a logic circuit 93 communicating via an input/output interface 94. A receiver 96 demodulates an RF signal arriving on electromagnetic coupler 98 to produce an input signal 95 to input/output interface 94. Typically, the input signal 95 conveys data transmitted by another element that is electromagnetically coupled to the ring bus. If the data is addressed to integrated circuit 90, input/output interface 94 passes the data to logic circuit 93. Otherwise input/output interface 94 encodes the data into an output signal 97 and passes it to transmitter 100. Transmitter 100 supplies an RF signal modulated by the output signal 97 to an electromagnetic coupler 102.

Please replace paragraph [0068] with the following amended paragraph:

[0068] Figures 15-16 illustrate an exemplary embodiment of the invention in which integrated circuits contactlessly communicate directly with each other. As shown in Figure 15 (a cross-sectional side view), a plurality (in this example three) of integrated circuits ~~112(1)-112(3)~~ 112(1), 112(2), and 112(3) are vertically stacked. For example integrated circuit 112(3) might include a computer processor and integrated circuits 112(1) and 112(3) might implement memories the processor accesses. Each integrated circuit ~~112(1)-112(3)~~ 112(1), 112(2), and 112(3) includes a substrate 116 in which is formed circuitry. For example, the circuitry might include a logic circuit, an input/output interface, and a transceiver or transceivers configured in an arrangement similar to that of integrated circuit 14 of Figure 4, integrated circuit 60 of Figure 8, or integrated circuit 190 of Figure 13. The transceiver in each integrated circuit ~~112(1)-112(3)~~ 112(1), 112(2), and 112(3) is connected to a corresponding electromagnetic coupler ~~118(1)-118(3)~~ 118(1), 118(2), and 118(3), which is preferably formed on or within substrate 116. Electromagnetic couplers ~~118(1)-118(3)~~ 118(1), 118(2), and 118(3) are located in proximity with each other so as to be electromagnetically coupled with one another. In this manner, integrated circuits ~~112(1)-112(3)~~ 112(1), 112(2), and 112(3) communicate with each other contactlessly through the silicon without requiring vias or conductive vertical elements to interconnect the stacked dice.

Please replace paragraph [0069] with the following amended paragraph:

[0069] Integrated circuits 112(1)-112(3) can be disposed such that each electromagnetic coupler ~~118(1)-118(3)~~ 118(1), 118(2), and 118(3) is electromagnetically coupled to all of the other electromagnetic couplers. Alternatively, the couplers ~~118(1)-118(3)~~ 118(1), 118(2), and 118(3) of integrated circuits 112(1), 112(2), and 112(3) may be tuned and "tightly" coupled to act as resonate transformers to pass RF signals vertically in either direction between electromagnetic coupler 118(1) and 118(3) of integrated circuits 112(1), 112(2), and 112(3) without minimum attenuation. In such arrangements, a transmission by one integrated circuit (e.g., 118(1)) would be received and decoded by all of the other integrated circuits. Only the integrated circuit to which the transmission was addressed, however, would keep and process the data in the transmission.

Please replace paragraph [0070] with the following amended paragraph:

[0070] Alternatively, each integrated circuit 112(1), 112(2), and 112(3) could be disposed (and or shielded) such that its electromagnetic coupler 118(1), 118(2), and 118(3) is electromagnetically coupled only to the electromagnetic coupler of the integrated circuit immediately above and/or below. A communications protocol such as that described above with respect to Figures 13 and 14 could be used. For example, upon receiving a transmission from a neighbor, an integrated circuit (e.g., 118(2)) decodes the destination address of the transmission. If the transmission is addressed to the integrated circuit, the integrated circuit decodes and processes the data in the transmission. If, however, the transmission is not addressed to the integrated circuit, the integrated circuit forwards the transmission to its other neighbor.

Please replace paragraph [0079] with the following amended paragraph:

[0079] Figures ~~17a to 17c~~ 17a, 17b, and 17c illustrate exemplary arrangements in which two or more integrated circuits are arranged with a direct wireless communication path or channel between two or more integrated circuits. The integrated circuits may be mounted on a printed circuit board (not shown) or other substrate or frame suitable for securing integrated circuits. In these exemplary arrangements, an electromagnetic coupler is formed on an outer edge of the integrated circuit. In Figure 17a, integrated circuits 600 and 604 are arranged such that they can wirelessly communicate with each other. In Figure 17b, three integrated circuits 610, 614, 418 are arranged such that each is able to wirelessly communicate with the other. In Figure 17c, one integrated circuit 630 includes four electromagnetic couplers, each arranged to be electromagnetically coupled to one of integrated circuits 634-646.

Please replace paragraph [0080] with the following amended paragraph:

[0080] In accordance with the shielding principles discussed above, shielding materials may optionally be included and disposed so as to fully or partially shield or "close" one or more contactless communications channels between the integrated circuits. For example, shielding material (not shown in Figures ~~17a to 17c~~ 17a, 17b, and 17c) may be placed between the electromagnetic couplers 601, 602, 611, 612, 613, 660, 662, 664, 666, 668, 670, 672, 674 (see Figures 17a, 17b, and 17c) and circuitry on any of the integrated circuits shown in Figures ~~17a to 17c~~ 17a, 17b, and 17c as generally described above. As illustrated in Figure 17a, shielding

planes or traces 606, 608 may also be disposed so as to shield the contactless communication path between two or more coupled electromagnetic couplers 601, 602. Although not shown in Figure 17a, additional shielding planes or traces may be included above and below (from the perspective of Figure 17a) integrated circuits 600 and 604 to more fully shield the contactless communication path between couplers 601 and 606. Similarly, shielding material 620, 622 may be disposed to shield the contactless communication paths among couplers 611, 612, 613 in Figure 17b, and additional shielding (not shown) may be included above and below (from the perspective of Figure 17b) the integrated circuits 610, 614, 618 to more fully shield the paths. Figure 17c likewise shows exemplary shielding material 650 shielding the contactless communication path between couplers 660 and 662 from the contactless communication path between couplers 664 and 666. Shielding material 648, 654, 652 similarly shields contactless communication paths between the following pairs of couplers: 668 and 670, 672 and 674, and 650, 652. Additional shielding material (not shown) could be placed above and below (from the perspective of Figure 17c) the coupling areas between adjacent couplers to more fully shield the contact communication paths.

Please replace paragraph [0081] with the following amended paragraph:

[0081] Although the electromagnetic couplers illustrated in ~~Figures 1-17c~~ 1, 2, 3, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17a, 17b, 17c, 18, and 19 are shown as being formed by straight line conductors, the couplers may be formed by conductors of any other shape including without limitation spirals. Indeed, the shape and size of the electromagnetic couplers can be selected to cause predetermined levels of inductance and capacitance so as to form tuned or resonate circuit or radio-frequency transformer structures. Moreover, as described above with respect to integrated circuits illustrated in Figures ~~1-16~~ 1, 2, 3, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16, electromagnetic couplers 601, 602, 611, 612, 613, 660, 662, 664, 666, 668, 670, 672, 674 are preferably formed on or within the integrated circuit using standard semiconductor fabrication techniques. Alternatively, the electromagnetic couplers can be fabricated as part of the semiconductor package.

Please replace paragraph [0082] with the following amended paragraph:

[0082] Figure 18 illustrates an exemplary spiral coupler 404 formed on or within a semiconductor substrate 402. Also formed on the substrate is transceiver circuitry 406 and functional circuitry 408, which may be similar to like circuits illustrated in Figures 4, 8, and 13. Figure 19 illustrates a circuit modeling equivalent impedances of the spiral coupler 404 and the transceiver circuitry 406 and a transmission line (not shown in Figure 18) or like coupler to which the spiral coupler 404 is coupled. In Figure 19, L1 and C1 represent the inductance and capacitance of spiral conductor 404 and its connection path to transceiver circuitry 406; R1 represents the input or output impedance of the transceiver circuitry 406; and L2 and C2 represent the inductance and capacitance of the transmission line (not shown in Figure 18) to which the spiral conductor 404 is coupled. <u>(Elements 404 and 406 are shown in Figure 18.)</u>